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USSR   UDC 621.375

ORIENTED GRAPHS FOR TRAVELING-WAVE TUBES IN PARALLEL

MALIVANCHUK, V. I. and PETINSKAYA, A. S.

[Abstract] Under consideration are two traveling-wave tubes operating in
parallel to supply a common load. A performance analysis by the topological
method with the aid of oriented graphs and the use of transmission coeffi-
cients, taking into account reflections as well as phase deviations, yields
the amplitude-frequency phase-frequency characteristics and the stability
criteria for the two symmetric hybrid configurations: synphasal-antiphasal
and quadrature. With useful as well as ballast loads in the circuit, the
stability of synphasal-antiphasal hybrid amplifiers with identical traveling-
wave tubes is found to be much higher. Figures 2; references 8: 3 Russian,
5 Western.
[110-2415]

2415
CSO: 1860

MAXIMIZING THE DIRECTIVE GAIN OF AN ANTENNA WITHIN THE LIMITS OF AN ANGLE
ZONE OF ELLIPTICAL SHAPE

MINKOVICH, B. M. and PRILEPSKIY, YE. D.

[Abstract] Optimization of the energy potential of a radio line with a
relatively wide angular working zone does not necessarily require the limit-
ing values of directive gain in the direction of maximum radiation. Optimi-
zation in this case is a minimax problem in which the minimum of the energy
potential is maximized within the limits of the angular working zone. Sec-
tions at the maximum distance from the center of the working zone are least
favorable from the energy standpoint, and the directive gain must be opti-
mized in the direction toward the boundary of the angular working zone. The
authors consider the particulars of this type of optimization when checking
the directive gain of antennas within the limits of an angular working zone
of elliptical or circular shape. The maximum attainable values of the di-
rective gain within the entire working zone are evaluated, and the relation
is found between these values and the surface utilization factor of the
antenna. The authors thank G. N. Kolcheyev for assistance in formulating
the problem. Figures 6; references 15: 7 Russian, 8 Western.
[81-6610]

6610
CSO: 1860

USSR   UDC 621.396.677.49

CHARACTERISTIC FEATURES OF CONVERSION OF SPACE-TIME SPECTRA BY PLANE
ANTENNA ARRAYS WITH COHERENT-OPTICAL SIGNAL PROCESSING

VORONIN, YE. N. and GRINEV, A. YU.

[Abstract] Conversion of space-time spectra by plane radio-optical antenna
arrays with coherent signal processing, after "weighting" by a "Dirac comb"
such as a light modulator, is analyzed in terms of processor characteristics
and antenna performance. After the diffractional efficiency and reduction
of a coherent-optical processor to an equivalent half as thick one have been
established, a radio-optical antenna with such a processor is regarded as a
dispersing lens. Elimination of ambiguity in direction readings by defocus-
ing of diffraction fringes due to mosaical light modulators such as a Pockels-
effect device is demonstrated both analytically and graphically. Figures 6;
references 6: 5 Russian, 1 Western.
[110-2415]

2415
CSO: 1860

USSR   UDC   62-52:681.3.06.44

ONE METHOD OF CORRECTION OF DATA IN A REAL TIME AUTOMATED CONTROL SYSTEM

MOROZOV, A. A., KUZ'MENKO, G. YE. and SHISHLOV, V. I.

[Abstract] A study is made of the task of analysis of the process of correc-
tion of the data base in real time automated control systems (ASU) in which
information is preliminarily assembled, tested and then transmitted to the
computer to be entered into the required file. The system consists of termi-
nal devices, a preprocessor, a buffer, a central processor and peripheral
storage. The system is analyzed as a queueing system in which flows of docu-
ments, requests for servicing, arrive from the terminals where they are gen-
erated. The information from the terminals is collected in the buffer under
control of the preprocessor until an end of text character is received from
one of the terminals. At this point, the buffer checks the information from
that terminal and transmits it to the central processor. Several methods of
organization of processing of documents in this peripheral disk document
buffer storage are considered. Modeling experiments indicate that substan-
tial improvement can be achieved only if document length does not vary too
much. Figures 4; references: 4 Russian.
[125-6508]

6508
CSO: 1860

USSR   UDC   621.372.512:681.3

COMPUTER-AIDED DESIGN OF OPTIMUM WIDEBAND MATCHING CIRCUITS

MALEVICH, A. P., KHIBENKOV, P. I. and CHAVKA, G. G.

[Abstract] The main problem in matching of complex loads over a wide fre-
quency range is to ensure throughout the necessary traveling-wave ratio at
the input of the matching circuit. The procedure is to subdivide the fre-
quency range and to match the load for each interval separately. In the

case of a precise design with a large number of frequency intervals covering a wide range the calculations become unwieldy and a program written for a Minsk-22 computer is now available. It includes subdivision of the frequency range consistently with the required traveling-wave ratio and subsequent automatic selection of the appropriate equivalent series or parallel load circuit for each frequency interval, followed by optimal matching of these equivalent load circuits and calculation of the matching-circuit parameters. The algorithm is based on the frequency characteristic of the input impedance of the load circuit and on an approximation of the reflection coefficient with a Chebyshev polynomial. The parameters of this approximation are selected so as to minimize the maximum value of the reflection coefficient within a given frequency interval and to satisfy a transcendental equation for the Q-factor of the equivalent load circuit, which involves using the method of indeterminate Lagrange multipliers. These parameters are then optimized by solution of a system of nonlinear equations by the method of secants and the dichotomy method. The algorithm includes correction of the traveling-wave ratio and of the upper limit of a given frequency interval. Figures 2; references 4: 3 Russian, 1 Western.
[110-2415]

2415
CSO: 1860

USSR   UDC 681.3.181.4.001.2

PROBLEMS IN USING A DIGITAL COMPUTER FOR DESIGN OF RADIO ENGINEERING EQUIPMENT

RUSIN, YU. S. and RUBINSHTEYN, G. YA.

[Abstract] Calculation of steady-state and transient characteristics of radio engineering equipment with the aid of a digital computer is based on a topological matrix description of such equipment. Making the algorithm not only more universal but also more efficient requires an appropriate method of numerical integration of differential equations, economical operation with rarefied matrices, and faster data preparation. Here an algorithm is proposed which meets these requirements and may in some cases be preferable to other known ones. Its gist is to divide the time period equal to the integration interval into k subintervals and then to determine, according

to the Euler method, the vector of independent state variables at points within these subintervals. The algorithm has been programmed in ALGOL for an M-222 digital or a BESM-4 digital computer. A comparative evaluation with other known algorithms applicable to systems of differential equations in the Cauchy form indicates that numerical integration with a given accuracy requires much less machine time here: 7.5 times less than by the fourth-order Runge-Kutta algorithm, at least 1.4 times less than by the Euler algorithm, 3.7 times less than by the prediction-correction algorithm, and 1.8 times less than by the implicit scheme according to Euler. The new algorithm is not faster and more accurate than the Adams algorithm, but better suitable for rectifier circuits with precise switching. The equations matrix is, furthermore, rarefied by truncating it to one with the consecutive numbers of nonzero elements in the first row and their values in the second row. Data preparation is accelerated by replacement of the original topological matrix with two arrays of decimal numbers, for positive and negative values separately. Figures 2; tables 1; references 7: 6 Russian, 1 Western. [114-2415]

2415
CSO: 1860

USSR

OPTICAL AUTOMATIC READERS

VOZIYANOV, A., Kiev

[Abstract] Keeping up with the high speed of modern computers requires a correspondingly fast data preparation and input. This is achieved by automatic readers capable of transferring data not from intermediate carriers but directly from original documents. Optical readers handle typewritten and legibly handwritten texts, in a proper graphic format, by recognizing and classifying the characters for subsequent encoding. Such a machine, interfaced with a minicomputer through an input-output device, includes a motor-driven rotating drum with a controlled document feeder, motor-driven lamp and readout head with an array of photodiodes, also an extremum indicator and a manual keyboard for input of unrecognizable characters. Readout is also possible by the "traveling beam" method with a vidicon rather than by "line-to-line" scanning. The machine operates with an arithmetic-logic device and a direct-access storage. A machine, the Unified System

YeS-6035, has been developed in the USSR for reading not only numerals and capital letters but also stylized Russian and Latin script at a rate of 500 characters/s with an error rate not exceeding $3 \cdot 10^{-6}$ and a failure rate not exceeding $3 \cdot 10^{-5}$. This machine was built in Moscow; there are also others produced elsewhere such as the "Blank" in Minsk and the "Ruta-701" in Vil'nyus. The use of optical readers is still limited in scope, mainly because of problems with handwriting recognition, paper quality, document storage and transport. Development of new integrated circuits and character recognition algorithms as well as better use of microprocessors and image scanning devices should broaden that scope. Figures 3.
[117-2415]

2415
CSO: 18

USSR   UDC 621.396

GROUND ANTENNAS FOR SATELLITE COMMUNICATION

POKRAS, A. M.

[Abstract] The design of ground antennas for satellite communication is
dictated not only by the kind of satellite orbit, elliptical ("Mol'niya")
with a 40,000 km apogee or geostationary circular at a 36,000 km altitude,
but also by the climate and, most importantly, the wind velocities. Such
antennas must, accordingly, feature a high gain and a low noise temperature.
The turntable mechanism must be suitable for automatic homing and tracking
of a satellite. The antenna must have structural and dynamic characteris-
tics adequate for maintenance of reliable performance under any likely con-
ditions. The two basic types of antennas developed during the nineteen
seventies in the USSR and abroad are those with full rotation ("Mars") and
simpler ones with limited rotation for operation with satellites in geosta-
tionary orbit only. Common features include two reflectors, modification
of the shape of the reflector surfaces for maximum surface utilization, and
standard conical horn radiators. Further developments in antenna design are
involved either with overall improvements in satellite communication systems
now operating in the 4-6 GHz frequency band or with attempts to adapt them
for operation at 11-14 GHz and even 20-30 GHz frequencies. An improvement
in the first category is the use of precisely circular opposite rotating
polarizations. An improvement in the second category is addition of a beam
guide consisting of four periscopic mirrors. Still another improvement,
for communication over satellites in a geostationary orbit, is varying the
position of the counterreflector by rotation. Most modern antennas use axi-
symmetric reflectors. Only with multibeam antennas, where elimination of
shading outweighs the drawback of a lower surface utilization factor, are
nonaxisymmetric reflectors also used. Particularly interesting are various
antennas recently built in Japan. Figures 7; tables 2; references 20: 15
Russian, 5 Western (including Japanese).
[114-2415]

2415
CSO: 1860

USSR   UDC 621.391.2

CONCERNING SOME NONPARAMETRIC APPROACHES TO DISTINGUISHING HYPOTHESES

GORBACHEV, A. A. and KOLDANOV, A. P.

[Abstract] Some nonparametric approaches are proposed for distinguishing
among several complex hypotheses with interfering parameters. The paper
gives the results of comparative analysis of a number of algorithms for
recognizing nonintersecting square pulses and narrow-band cw interference
against a background of Gaussian noise. It is shown that methods of non-
parametric statistics are productive under conditions where classical methods
of parametric statistics are inapplicable for constructing similar (unbiased)
tests. Tests based on partition, and also tests of the Pearson lambda type
provide a regular means of accounting for the specifics of parametric assign-
ment of hypotheses. The feasibility of using these approaches is confirmed
by algorithms obtained for recognizing interference situations. In a num-
ber of cases these algorithms have satisfactory quality characteristics,
and the better ones allow relatively simple technical realization. Figures
2; references 15: 12 Russian, 3 Western.
[81-6610]

6610
CSO: 1860

USSR   UDC 621.391.2

INVARIANT ALGORITHM OF SIGNAL RECEPTION AGAINST A BACKGROUND OF WHITE
GAUSSIAN NOISE AND LUMPED INTERFERENCE

PROKOF'YEV, V. N.

[Abstract] The author considers the problem of signal reception in the
presence of lumped interference in the form of a combination of sine waves
with unknown amplitudes and initial phases accompanied by white gaussian
noise of unknown power. It is assumed that the frequency of the interfer-
ing waveforms is known. Invariant algorithms are proposed for signal

reception. In the case of long observation periods, the proposed rules are applicable to non-white and even to non-gaussian noise. If a generalized linear process is observed, the variable coefficients are asymptotically independent and normal, and invariance of the resolving rule is preserved for any finite observation period. References: 8 Russian.
[81-6610]

6610
CSO: 1860

A SIMPLE METHOD OF CALCULATING DISTORTIONS OF FM SIGNALS IN THE PRESENCE OF RADIO INTERFERENCE

BYKHOVSKIY, M. A.

[Abstract] The author proposes a method that considerably simplifies calculations of the permissible level of radio interference at the receiver input when the frequency spectrum of a useful signal overlaps the interference spectrum. Such calculations are needed when analyzing the electromagnetic compatibility of FM communication systems with other electronic systems. Formulas are derived for calculating the noise power in a telephone channel of systems with frequency modulation acted on by radio interference from systems with frequency and pulse modulation. A comparison of the calculated values of noise power with results found theoretically by numerical integration and also with experimental data shows that the proposed technique is highly accurate. Figures 1; references: 6 Russian.
[81-6610]

6610
CSO: 1860

ESTIMATION OF THE DYNAMIC RANGE OF A CADENCE-FREQUENCY DISCRIMINATOR IN A
REGENERATOR SYSTEM

ZINGERENKO, YU. A. and PLOTKIN, M. A.

[Abstract] Digital data transmission systems are considered with gating
pulses formed from the harmonic signal at the output of a cadence-frequency
filter-discriminator. Variations of the signal amplitude cause phase fluc-
tuations of the linear signal and thus lower the fidelity of transmission.
With a simple bipolar code used as a linear one, after preliminary scram-
bling of the original binary code, the dynamic range of a narrow-band filter
widens infinitely in the ideal case. Here the relation between the maximum
variation of the signal amplitude and the probability of such variations
is analyzed, these variations being smoothed anyway as a result of some in-
ertia in a real filter. Calculations are shown assuming a digital sequence
of alternate pulse packets with N/2 code symbols in each at the filter in-
put, based on an averaging interval at 20 dB and on the consequences of
lengthening it according to the Bernoulli theorem. As this interval becomes
longer, the dynamic voltage range at the cadence frequency tends to increase
less steeply with increasing probability of such a range and eventually re-
mains constant. In a typical case of a quartz filter in a digital data
transmission system operating at the rate of 34,368 Mbit/s with a bandwidth
of 17 kHz, for instance, the averaging interval is N= 2000 and the dynamic
range will not exceed 2 dB with a probability of 10^{-18}. Figures 2; refer-
ences 5: 3 Russian, 2 Western.
[114-2415]

USSR   UDC 621.396

A METHOD OF PERFORMANCE EVALUATION AND SYNTHESIS OF ASYNCHRONOUS SUBSCRIBER
COMMUNICATION SYSTEMS

UMRIKHIN, YU. D.

[Abstract] Asynchronous subscriber communication systems, based on code
multiplexing and frequency-channel sharing, are widely in use because of
their advantage which include a high interference immunity and a great
flexibility. Here an algorithm of analyzing the performance requirements
is shown which uses the mathematical random-process model of service quality
in the presence of interference. It is followed by an algorithm of system
synthesis which consists of five steps with a convergent iteration. In the
case of a digital communication system, this algorithm will be modified and
can be extended as specifically necessary. Technical and economic con-
straints as well as installation and operation scheduling factors may re-
quire a review of the synthesis for elimination of contradictory require-
ments or a tradeoff. Figures 3; references: 11 Russian.
[114-2415]

2415
CSO: 1860

USSR   UDC 621.396.2

USING COMPLEX SIGNALS TO CONSTRUCT A DISCRETE DATA TRANSMISSION SYSTEM
THAT IS INVARIANT TO CHANGES IN SIGNAL FREQUENCY AND PHASE

OKUNEV, YU. B., PER'KOV, V. V. and YAKOVLEV, L. A.

[Abstract] B. N. Petrov's two-channel principle of the theory of invari-
ance of automatic control systems sets a necessary and sufficient condition
for absolute invariance to an arbitrary interfering effect: two realizable
channels for transmission of this effect in the system. The authors apply
this principle to design of a discrete data transmission system invariant
to arbitrary fluctuations of signal frequency and phase. The required

second channel is set up by a special pilot signal subject to the same interfering action as the main information signal. The problem is solved by simultaneous transmission of the information and pilot signals in the same frequency band. The principles of construction of such a data transmission system are examined. Analysis of the interference immunity of the proposed system shows that it is feasible. Figures 2; references: 12 Russian.
[81-6610]

6610
CSO: 1860

ALGORITHM FOR HIERARCHICAL MODELING OF HEAT EXCHANGE PROCESSES IN COMPLEX ELECTRONIC SYSTEMS

DUL'NEV, G. N., POL'SHCHIKOV, B. V. and POTYAGAYLO, A. YU.

[Abstract] A hierarchical principle is proposed for simulating temperature fields in electronic equipment complexes. In this approach the system is broken down into several levels from separate components (integrated circuits, semiconductor devices, micromodules) on the lowest level to the rooms that accommodate the racks, equipment bays and so forth on the highest level. This technique enables the designer to account for all energy factors beginning with the ambient atmosphere and ending with heat release in an IC chip. It is shown that the method reduces modeling to analysis of several models, with each level corresponding to only one model. Flowcharts are given for algorithms that simulate the temperature field in electronic equipment complexes. These algorithms can be used for automated calculation of heat fields. Figures 5; references: 10 Russian.
[81-6610]

6610
CSO: 1860

USSR   UDC   621.396.229/088.8

ACCURACY OF SIMULATION OF RADIO CHANNELS

OBOLONIN, I. A. and SERYKH, V. I.

[Abstract] The relative error probability is an appropriate quality cri-
terion of simulation accuracy in the case of discrete data transmission
systems. Estimating this quantity for channels with random parameters in-
volves determining how it depends on the accuracy with which the channel
parameters have been simulated and on the accuracy with which the distri-
bution of channel output signals has been approximated. Here the first part
of the problem is solved by the method of small increments and the second
part is solved on the basis of Kolmogorov statistics with application of
the Bunyakovskiy inequality. Calculations for a binary data transmitting
channel with slow fading, Rayleigh fading in the case of coherent reception
or quasi-Rayleigh fading in the case of noncoherent reception, yield a maxi-
mum relative error probability close to experimentally established levels.
The authors thank YU. S. SHINAKOV for his comments contributing to an im-
provement of this analysis. References: 1 Russian.
[114-2415]

2415
CSO: 1860

USSR   UDC   621.396.62.019.4

ESTIMATION OF THE EFFECT OF INTERMODULATION INTERFERENCE ON THE INTERFERENCE
IMMUNITY OF RECEPTION WITHIN THE SHORTWAVE RANGE

POBEREZHSKIY, Y℉. S. and SOKOLOVSKIY, M. N.

[Abstract] Interference immunity of shortwave radio receivers with station
interference as well as $2f_1 - f_j$ and $f_1 + f_j - f_1$ intermodulation interference
is considered, and the probability of cutoff due to intermodulation inter-
ference is calculated as a function of the station interference statistics.

Both the wideband segment and the narrow-band segment of the receiver chan-
nel are assumed to have rectangular amplitude-frequency characteristics.
The frequency range of the wideband segment is subdivided into n intervals,
the width of each equal to the mean width of the station interference spec-
trum and also to the bandwidth of the narrow-band segment. Each intermodu-
lation interference and the station interference all have a log normal dis-
tribution, the station interference also assumed to be sinusoidal. Inter-
ference within each frequency interval of the wideband segment is, moreover,
assumed to be independent. Cutoff will occur when the rms interference volt-
age exceeds the threshold voltage within the s-th frequency interval of the
wideband segment which corresponds to the frequency band of the narrowband
segment. Calculations on this basis yield the lower limit of the cutoff
probability; the upper limit can be found only under certain conditions de-
pending on the intermodulation interference characteristics. Figures 2;
references 6 (Russian).
[114-2415]

2415
CSO: 1860

IMPROVING THE INTERFERENCE IMMUNITY OF OPTICAL ATMOSPHERIC COMMUNICATION
LINES

TOLPAREV, R. G. and BORISOV, E. V.

[Abstract] Polarization modulation is the optimum technique from the stand-
point of interference immunity of optical signal reception in the direct
method of detection. However, since photodetectors react only to energy
parameters, polarization modulation is converted to intensity modulation in
signal reception. Consequently the intensity fluctuations typical of at-
mospheric channels will influence the quality of operation of a system with
polarization modulation. Under these conditions, AGC should be used to at-
tenuate this multiplicative interference in signal processing at the receiv-
ing end in receivers that are optimum for stationary channels. The authors
propose a practical version of such a receiver circuit based on an optical
receiver for signals with pulse code modulation by polarization. A compara-
tive evaluation is made of the interference immunity of reception of a

signal with polarization modulation under conditions of multiplicative interference with and without AGC. The results show that in the optimum wave band the use of AGC has a great potential for reducing the effect of multiplicative interference in communication channels and enhancing interference suppression. Figures 2; references: 3 Russian.
[81-6610]

6610
CSO: 1860

USSR   UDC 621.316.54:531.781.2.082.73

SENSOR TYPE SWITCHING DEVICES UTILIZING PIEZORESISTORS

KATSNEL'SON, A. A., engineer

[Abstract] Sensor type switching devices represent a combination of a
sensor and a threshold element. A description is given of elements of this
sort, employing piezoresistors made of electroconductive paper developed at
the Moscow Area Scientific Research and Planning and Design Coal Institute
(PNIUI). These elements are used as sparkproof devices in mining automatic
devices. They consist of a packet of sheets of electroconductive paper
placed between two metal plates which are furnished with leads. Their oper-
ating principle is based on the dependence of the contact resistance between
the sheets of electroconductive paper on the force with which they are com-
pressed. For piezoresistors $R = n\rho k/SF$, where R is the resistance of the
piezoresistor, n is the number of sheets of electroconductive paper, ρ is
the resistivity of the paper, S is the area of the paper sheets, F is the
compressive force and k is the contact resistance coefficient. The resis-
tance coefficient. The resistance of a piezoresistor can vary from $R \to \infty$
with $F = 0$ to $R = 10$ to 10^6 Ω when a piezoresistor is pressed by a finger
with a force of 0.1 to 50 N. These piezoresistors have an area of 0.5 to
5 cm^2 and are about 1 to 2 mm thick, making them well suited for placing on
manual remote control consoles. Rubber gaskets are employed for mounting
and leads are sealed. The permissible current density of these piezoresis-
tors when they are pressed for a short time is 10 mA/cm^2 maximum. They can
thus be used for direct control of a low-power relay. The entire control
circuit can be sparkproofed if the threshold element is of the non-contact-
ing type. Illustrations are given of possible variants of the schematic
diagrams of switching devices of the kind described. A description is given
of a pushbutton arrangement used to close a circuit. These piezoresistors
have been used successfully for many years for static and dynamic measure-
ments in laboratory and mine investigations. Figures 2.
[76-8831]

8831
CSO: 1860

USSR

CALCULATION OF INHOMOGENEITIES IN A STRIPLINE

SHESTAK, G. N.

[Abstract] A method of calculating the inhomogeneities in symmetric strip-
lines is proposed which uses an equivalent inhomogeneity with magnetic lat-
eral walls, equal wave impedances and phase velocities serving as the equiva-
lence criterion.   In the quasi-static approximation for the inhomogeneity
zone, the electric field is regarded as an electrostatic one with a constant
potential difference between the electric walls and the magnetic field is
regarded as a magnetostatic one due to a direct current flowing in those
walls. The electric field is, moreover, everywhere uniform so that the
capacitance of such an equivalent line is that of a plane capacitor. The
magnetic field is not uniform but plane, on the other hand, so that the in-
ductances of such an equivalent line can be determined through conformal
mapping. This method does not require calculation of waveguide inhomogenei-
ties nor a twofold dual transition. Formulas have been derived by this
method for a wye, a delta with unequal arms, an orthogonal intersection,
a sudden widening of the center strip, and a center strip bent at any angle.
Figures 2; tables 1; references 5: 2 Russian, 3 Western.
[110-2415]

2415
CSO: 1860

SYNTHESIS OF REFLECTION AND TRANSMISSION COEFFICIENTS CORRECTORS ON SEGMENTS
OF NONHOMOGENEOUS STRIPLINES FOR A FOURPOLE NETWORK MISMATCHED WITH BOTH THE
GENERATOR AND THE LOAD

BOBROV, I. N. and GAPONENKO. G. YA.

[Abstract] Synthesis of a nonhomogeneous stripline is considered for cor-
rection of reflection and transmission coefficients in a fourpole network
such as a waveguide channel with mismatch between the generator and the
load. The scattering matrix of this corrector on the load side is derived
from the scattering matrix of the fourpole, with multiple reflections dis-
garded for simplicity, and its coefficients, belonging to the class of whole
functions with absolutely integrable squares, are evaluated by the variation
method in operator form and the T-mode approximation. Figures 1; references:
10 Russian.
[110-2415]

2415
CSO: 1860

CALCULATION OF THE DISPERSION IN A MICROSTRIPLINE

IVANOV. I. T.

[Abstract] The dispersion in a microstripline according to the model with
a rectangular slot on one side is

$$\varepsilon_e = (\frac{c}{v_\phi})^2 = \varepsilon - \frac{\varepsilon - \varepsilon_{e0}}{1 + (f/f_r)^2 G}$$

(ε relative dielectric permittivity of the substrate, ε_{e0} and ε_e static and
dynamic relative effective dielectric permittivity). Various approximations
have been made for the evaluation of coefficient G. Here an expression is

derived for C. also as a function of the static wave impedance, applicable to a microstripline of any geometry or ratio of substrate thickness to slot depth and with any substrate material (ε). This method is found to yield more accurate dispersion characteristics than other known methods. Figures 4; tables 1; references 8: 2 Russian, 6 Western.
[110-2415]

A MULTIPAD WIDEBAND MICROWAVE LOAD

ZAYENTSEV, V. V., VINOGRADOV, G. A. and ZAYENTSEV, L. V.

[Abstract] It is possible simultaneously to widen the frequency range of matching and raise the permissible level of absorption power by connecting two or more absorption pads through compensating line segments. Here the performance characteristics of a 2-pad absorber are analyzed on the basis of an equivalent lumped-parameter RC parallel circuit of a film device with a negligible inductance of the lead wires. Calculation of the standing-eave ratio as a function of the frequency shows that, with an optimum geometry of the compensating line segments, the performance of a 2-pad absorber is improved by connecting two such absorbers in parallel. The theoretical conclusions have been confirmed by experiments with 50 Ω pads made of resistive nichrome films on beryllia substrates, absorbing up to 150 W over the 30-980 MHz frequency range. Figures 3; references: 1 Russian.
[110-2415]

UDC   621.372.54.037.372

EFFECTIVENESS OF NONRECURSIVE DIGITAL REJECTION FILTERS

POPOV, D. I.

[Abstract] The effectiveness of interference rejection by nonrecursive
digital filters depends on the degree to which incoming oscillations can be
discretized. Here this effectiveness is characterized by the ratio of trans-
mission coefficients, interference to white noise, and by the coefficient of
subinterference visibility. The dispersion of quantization errors at the
filter output and the resulting loss of visibility are also taken into con-
sideration. These concepts apply to filters synthesized on the basis of a
Fourier series expansaion, with a Hamming weighting function, as well as to
filters synthesized on the basis of passband and stopband requirements. Fol-
lowing a performance analysis from this standpoint, it is possible to design
filters for interperiod compensation devices with the maximum passband for a
given order, as demonstrated on a rejection filter with a +2 dB nonuniformi-
ty in the passband. Figures 3; references 5: 3 Russian, 2 Western.
[114-2415]

2415
CSO: 1860

UDC   621.372.54.037.372

SYNTHESIS OF DIGITAL RESONATORS FOR NARROW-BAND FILTRATION SYSTEMS

ALPATOV, B. A., VITYAZEV, V. V. and STEPASHKIN, A. I.

[Abstract] One method of frequency sampling in digital narrow-band filtra-
tion systems is by means of a comb filter in series with an array of recur-
sive cosine resonators, most economical from the standpoint of the number of
multiplications required and the necessary memory capacity. Here an algo-
rithm of synthesis is shown which yields an analog of a comb filter so that,
with the necessary weighting function of infinite length, a given bandwidth
and attenuation beyond the passband as well as a linear phase-frequency
characteristic can be attained without the need for precise discretization

of harmonic functions. It requires four multiplications without rounding off. A computer based on this algorithm is faster and smaller even than one for synthesis of recursive cosine resonators. The method is also applicable to filters with arbitrary complex frequency characteristics. Figures 2; references: 3 Russian, 1 Western in translation.
[114-2415]

2415
CSO: 1860

CALCULATING THE COEFFICIENT OF ACOUSTIC COUPLING IN TWO-RESONATOR MONO-LITHIC QUARTZ FILTER STRUCTURES

ROGOZIN, YU. I.

[Abstract] Two-resonator structures consisting of a pair of acoustically coupled wave resonators on a quartz plate are widely used in monolithic quartz filters both as independent units and as individual sections of mul-tiple-resonator filters. A number of characteristics of such filters, such as the width of the passband and the identity of amplitude-frequency and phase-frequency responses are determined by the coefficient of acoustic coupling between resonators located on a single plate. The author examines existing formulas for calculating acoustic coupling, and proposes a new more precise formula that reduces the error by at least an order of magni-tude. Figures 3; tables 2; references 3: 1 Russian, 2 Western.
[81-6610]

6610
CSO: 1860

A Y-CIRCULATOR ON A STRIPLINE WITH A SUSPENDED SUBSTRATE

KALININA, T. D., KUDRYACHEV, L. K. and MANOYLOV, V. F.

[Abstract] A Y-circulator has been built with a stripline on a dielectric
substrate inside a rectangular metal pipe, mounted on a ferrite resonator
at the center and on matching spacers on both sides. It was produced by
the planar technology, including deposition of a 10 μm thick copper layer
and photolithography, with a 200-300 Å thick chromium underlayer ensuring
better adhesion to the substrate. It has been designed for full circulation
and impedance matching at the center node over the 8-12 GHz frequency band.
The effective dielectric permittivity increases linearly with the frequency,
more with a ferrite than with a pyro(glass)ceramic substrate. Figures 2;
tables 1; references: 5 Russian.
[110-2415]

2415
CSO: 1860

USSR

USE OF INTEGRATED CIRCUITS IN ELECTRONIC HOUSEHOLD APPLIANCES

GAL'PERIN, YE. I.

[Abstract] The paper gives a brief report on the All-Union Scientific and Technical Conference on the Use of Integrated Circuits in Electronic House-hold Appliances held in Simferopol' in November 1978. The conference was organized by the Central and Crimean Administration of the Scientific and Technical Society of Radio Engineering, Electronics and Communications imeni A. S. Popov, together with the Ministry of the Communication Equipment In-dustry, the Ministry of the Electrical Equipment Industry and the Ministry of the Radio Industry. The conference was attended by representatives from scientific-research institutes, design offices, plants and higher education-al institutions from 30 Soviet cities. Principal attention was focused on the use of microelectronics in radio and television equipment, TV games, tape recorders and electronic watches. Problems of electronic automation of design were considered, and also the outlook for development of electronic household appliances outside the Soviet Union. Note was taken of the devel-opment of a microelectronics base by Soviet industry, and Soviet output of consumer devices based on ICs. ICs are now being produced for AM and FM channels of radio receivers, the image, audio and chrominance channels of TV receivers, and for tape recorder components. ICs are being developed for volume and tone controls, touch-tuning, LSI chips for TV games, and so on. Devices now being produced with integrated circuitry include the Mayak-203 and Proton-301 tape recorders, the Rubin television set, electronic watches and hand-held calculators.
[81-6610]

6610
CSO: 1860

USSR

INTERNATIONAL SYMPOSIUM ON ELECTROMAGNETIC COMPATIBILITY

LEONOV, V. A.

[Abstract] The Fifth International Symposium on Electromagnetic Compatibility (EMC) is to be held in Wroclaw, Poland from 17 through 19 September, 1980. There will also be an exhibition of equipment and devices used in solving EMC problems. Organization of the symposium and exhibition is under the auspices of the International Radio Scientific Union [IRSU], the International Special Committee on Radio Interference [CISPR] and other agencies. The official languages will be English and Russian. Abstracts of papers are to be submitted in quintuplicate in both languages no later than September of 1979, and the complete text of the paper must be received no later than February of 1980. Questions on the symposium should be addressed to the Soviet branch of CISPR in Leningrad.
[81-6610]

6610
CSO: 1860

COMPENSATION OF THE TEMPERATURE ERROR IN A RESISTIVE TRANSDUCER OF ELECTRIC
FIELD INTENSITY AT MICROWAVE FREQUENCIES

DAGIS, M. I. and SKUCHAS, YU. P.

[Abstract] Semiconductor n-Si devices with heating of charge carriers by an
electric field within the bulk are used as resistive transducers for measur-
ing the electric field intensity at microwave frequencies. Here the tempera-
ture characteristics of such devices are analyzed, particularly the tempera-
ture dependence of their nonlinearity in different crystallographic direc-
tions in materials with higher or lower electrical resistivity. On this
basis, two simple resistive error compensating circuits are designed which
are sufficiently accurate for transducer operation as a voltage device with-
in the linear range of its amplitude-frequency characteristic. With some
additional complexity, the dynamic range of field measurements can be easily
extended. Figures 6; tables 1; references 10: 8 Russian, 2 Western.
[110-2415]

2415
CSO: 1860

AN M-TYPE ELECTRONIC MICROWAVE CONVERTER

GRECHUSHKIN, K. V., GURZO, V. V., PROKUSHKIN, V. N. and STAL'MAKHOV, V. S.

[Abstract] An electronic microwave converter with crossing fields is con-
sidered with an electron beam injected into the interaction space under
near cyclotron resonance conditions. The high-frequency energy pumped to
it in the process is almost completely converted to rotational energy of
electrons so that the trajectory of each electron becomes cycloidal. Elec-
trons are collected within the drift zone along the beam axis where their

resultant velocity is near zero. Such a trajectory transformation requires
that either one of the two crossing static fields, electric or magnetic, be
nonuniform. An analysis of electron ballistics and energy relations in an
M-type device with a nonuniform electric field produced by electrodes of a
hyperbolic shape, for instance, indicates a high efficiency of such a con-
verter. Figures 3; references 4: 3 Russian, 1 Western.
[110-2415]

2415
CSO: 1860

TRANSMISSION OF PICOSECOND PULSE SIGNALS OVER A SUPERCONDUCTOR LINE

KRYLOV, V. V. and MIGUNOV, L. V.

[Abstract] A reflectometer examination of superconductor cables has revealed
both random and regular inhomogeneities, due to bending which miniaturization
of cryogenic devices requires. A bend can be regarded as a smooth transition
between two identical lines and accordingly the transmission equations for
such a cable are set up here on the basis of an equivalent RLC series circuit
with the capacitance C shunted by an L_1C_1 branch. Disregarding dispersion,
which appears as a cubic term in the propagation constant as an otherwise
linear function of the frequency, and disregarding negligible dissipation,
the solution to this system of equations is sought in the form of a Taylor
series for a single perturbation propagating from the source to the load.
In the case of significant multiple reflections of transmitted signals it
becomes necessary to solve the problem by simulation on a digital computer,
to account for discretization. Typical design and performance calculations
have been made for a 20 m long miniature superconductor cable wound into a
coil 100 mm in diameter for transmission of picosecond voltage pulses. Non-
linear effects tend to lengthen the risetime and shorten the pulse duration,
but these distortions become stabilized as the nonlinearity of superconductor
films compensates dispersion and dissipation. Figures 3; references 7: 5
Russian, 2 Western.
[110-2415]

2415
CSO: 1860

USSR   UDC   621.372.852.6

AUTOTRANSFORMERS WITH MAXIMUM FREQUENCY BANDWIDTH

LONDON, S. YE. and TOMASHEVICH, S. V.

[Abstract] A new principle is proposed for making the windings of line transformers: the conductors of each winding form a multiconductor line that consists of two stages of equal length with specific characteristic admittance ratios. These ratios ensure complete matching in the upper frequency region. Such an arrangement maximizes the frequency bandwidth and minimizes transformer dimensions. Autotransformers based on this principle are considered: asymmetric, symmetric and balancing line transformers of the autotransformer type. Figures 10; references 7: 6 Russian, 1 Western. [81-6610]

6610
CSO: 1860

USSR   UDC   621.783.2.001.3

NEW SERIES OF ELECTRIC FURNACES AND UNITS FOR GENERAL INDUSTRIAL PURPOSES

OSIPOV, I. V., engineer

[Abstract] A description is given of promising series of continuous electric furnaces for use in heat treating which have been developed by VNIIETO [All-Union Scientific-Research Institute of Electrothermal Equipment] and which have become widespread in industry, such as traveling ovens, shaker-hearth furnaces, roller conveyer furnaces for the bearing industry and periodic furnaces of the shaft and large-scale type. The nomencluatre of parts which can be treated in the new series of continuous hardening and tempering furnaces and units has been expanded to include parts weighing up to 5 kg and measuring 5 X 5 X 5 mm, whereas the old furnaces could handle parts weighing up to 3 kg and measuring 10 X 10 X 10 mm. Fifteen heat treating processes will be able to be carried out as opposed to five in the old

furnaces. The new units will employ such advanced heat treating techniques as quenching in hot oil, isothermal hardening, and nitrogen case hardening. Units for quenching in oil or water have a capacity of 110 to 1400 kg/h, units for nitrogen case hardening from 100 to 240 kg/h, and for isothermal hardening, 110 to 380 kg/h. Improvements incorporated include the installation of washing and drying machinery next to hardening furnaces and furnaces for nitrogen case hardening, the installation of deep hardening tanks and the mechanization of loading of parts. The series of electric furnaces and units with a shaker hearth represents a first-time development. Being produced at present are just two models of hardening and tempering units for heat treating parts measuring not less than 5 mm. The new series has provision for treating parts measuring as little as 1 mm. These furnaces also incorporate the new processes listed above, with the addition of normalizing and annealing and stabilization cooling. The new series of shaker-hearth furnaces provides for 55 arrangements of units for 20 heat treating processes. The development of hardening and tempering units for the bearing industry was occasioned by the many advantages which roller conveyer furnaces have over the traveling ovens and shaker-hearth furnaces used at the present time. These include the elimination of the cooling and deformation of races when they are transferred to the hardening medium because of the capability of rapid oriented loading into the furnace and unloading from the furnace into hardening equipment, and the long service life of a roller conveyer as compared with a conveyer belt and a shaker hearth. In the new units it is possible to heat treat races with a diameter of 80 to 850 mm. The stability of the temperature in the working space of the furnace has been increased to +5°C. Uniformity in chilling has been improved, resulting in a reduction in deformation of races and variance in the quality of heat treated races. The series of large-scale shaft furnaces represents a first-time development. These furnaces can be used for heat treating bearing races, pinions, shafts, gears and other large products of different shapes and weights in the environment of a protective gas. This series includes furnaces with a maximum temperature of 700°C for tempering steel products and for heat treating non-ferrous metals and alloys in a protective atmosphere, case hardening furnaces with a maximum operating temperature of 950°C for case hardening and nitrogen case hardening of steel products and heating prior to hardening, furnaces with a maximum temperature of 1000°C for heating products prior to hardening, annealing and normalizing in a protective atmosphere, and furnaces with a maximum temperature of 1200°C for heating products made of alloy steel in a protective atmosphere. Mastery of the series production of the new type of traveling electric ovens is slated for 1980 to 1985. The creation of experimental models of the new continuous furnaces and shaker-hearth furnaces is intended in 1979 and 1980, respectively.
[77-8831]

8831
CSO: 1860

USSR   UDC [548.55:621.327.532].002.2

EQUIPMENT FOR GROWING SAPPHIRE TUBES FOR HIGH-PRESSURE SODIUM VAPOR LAMPS

PEL'TS, B. B., YEGOROV, L. P., ZATULOVSKIY, L. M., CHAYKIN, P. M. and FREYMAN, YE. A., candidates in technical sciences, and KRAVETSKIY, D. YA., engineer

[Abstract] A description is given of a technology and equipment, developed by VNIIETO [All-Union Scientific Research Institute of Electrotechnical Glass and Engineering Equipment], for fabricating gas discharge tubes from monocrystalline aluminum oxide (sapphire) for use in high-pressure sodium vapor lamps. Into a crucible containing an aluminum oxide melt is placed a former, wetted by the melt, with a capillary tube. The melt is lifted up the capillary tube to the upper end of the former because of surface tension. A monocrystalline sapphire seed crystal oriented along line [0001] is lowered until it touches the end of the former. The end of the seed crystal is then fused and a melt column communicating with the melt in the capillary tube is formed between the seed crystal and the former. The seed crystal is then lifted at a specific rate with a programmed lowering of voltage in the inductor. As it is lifted, at the end of the seed crystal the melt crystallizes and the crystal grows on both sides of the seed crystal along the annular capillary tube. When the growing edges of the crystal join into a ring the crystal acquires a tubular shape and the crystal's cross section conforms to the geometry of the end of the former along which the aluminum oxide melt wetting it flows. This process is superior to the process of making tubes from sintered aluminum oxide in that it contains only one major operation, i.e., growing a tubular monocrystal, whereas the previous method contains more than 20 labor intensive operations, requires complicated precision equipment and results in tube parameters with insufficient reproducibility. A group process has been mastered for producing six sapphire tubes from a single crucible. Two units have been developed for growing sapphire tubes, type IZV-O,4.4,5/23I1 for a tube length of 450 mm and IZV-O,4.12/23I1 for a tube length of 1200 mm. These units are compatible with the equipment for growing monocrystals of semiconductors by the Czochralski method. Each unit contains a sealed chamber in which thermal processing takes place, a precision pulling mechanism with a pulling rod which enters the chamber through its upper collar, systems for automatically controlling temperature conditions with a precision of $\pm$ 2°C and the pulling rate with a precision of $\pm$ 1.5 percent, a power supply with an 8000 Hz mechanical generator, a high-frequency transformer and capacitor bank, systems for evacuating and admitting an inert gas and for water cooling, and testing and measuring equipment. The IZV-O,4.12/23I1 unit is designed for producing sapphire crystals with a cross section with a diameter of 40 mm and 1200 mm

long, and six tubes with a maximum diameter of 10 mm can be grown simultane-ously. Sapphire tubes are superior to sintered aluminum oxide tubes with regard to geometry, porosity, chemical resistance to sodium vapors, and mechanical and electrical strength, and have 17 percent better light trans-mission. The Armelektrosvet Production Association has developed a tech-nology for making 250, 400, 700 and 1000 W high-pressure sodium vapor lamps utilizing sapphire gas discharge tubes. Tests have shown that lamps with sapphire tubes have considerably greater light output and service life. The savings from the manufacture of 100,000 lamps equals 1.2 million rubles per year. VNIIETO has produced models of tubes, rods and plates of different shapes with a cross sectional diameter of 2 to 40 mm, from sapphire. A pho-tograph is shown of some of these products, which have successfully passed tests in a number of instruments and pieces of equipment used in electronics, metallurgy and instrument making. Figures 2; references 4: 3 Russian, 1 Western.
[77-8831]

8831
CSO: 1860

USSR   UDC 621.372.83

DEPENDENCE OF THE BANDWIDTH ON THE GEOMETRICAL DIMENSIONS OF A RETREADING SYSTEM CONSISTING OF A CHAIN OF COUPLED RESONATORS

PRAVDA, V. I. and PIROGOVA, N. B.

[Abstract] Traveling wave amplifiers include a retarding system which con-sists of a chain of coupled resonators with positive mutual inductance. They usually operate within a narrow frequency band near the top where the coupling impedance is high. The dependence of the bandwidth of such a sys-tem on its geometrical dimensions has been examined by evaluating the effect of changes in some basic dimensions on the dispersion characteristic. Com-puter-aided engineering calculations, in fair agreement with experimental data, indicate that the dispersion characteristic in the phase plane flat-tens and the bandwidth increases with increasing cavity diameter and increas-ing window width. The bandwidth also increases with a larger system pitch, but the dispersion characteristic steepens in a changing phase plane. Other geometrical dimensions of the system do not influence the bandwidth signifi-cantly. Figures 5; references: 3 Russian.
[110-2415]

2415   32
CSO: 1860

DESIGN OF A COMB-TYPE RETARDING SYSTEM

BURTSEV, V. V. and OVCHAROV, V. T.

[Abstract] Toward the design of a retarding system, the dispersion char-
acteristics and the coupling impedance of an infinitely wide comb line with
an arbitrary taper are calculated on the basis of the Flocke theorem, taking
into account the comb periodicity, whereupon the critical wave numbers of a
magnetron system without π-mode straps are determined. The calculations,
starting with the Hertz vector, include transformation to fast converging
series for easier computer-aided numerical evaluation. Figures 4; tables
1; references 1 (Russian).
[110-2415]

2415
CSO: 1860

HIGHER HARMONICS IN A TRAVELING-WAVE TUBE WITH A POTENTIAL JUMP

VASYUTIN, V. D., MALIVANCHUK, V. I. and OLEKH, N. YA.

[Abstract] A traveling-wave tube with a helical retarding system without
an absorber and the effect of a potential jump near the maximum efficiency
are considered. The second-harmonic power has been calculated in the case
of a nondispersive retarding system as well as with either normal or anoma-
lous dispersion of the phase velocity, taking into account the presence of
higher harmonics and effects due to a potential jump, over the range of
slip from -1 to 2 with a zero loss distribution factor. With a potential
jump the efficiency is found to be almost twice as high as in a homogeneous
tube and the relative level of second-harmonic power is 3-5 dB lower. The
latter depends on the dispersion, a potential jump not raising the efficien-
cy significantly in the case of a weak normal dispersion but raising it

appreciably in the case of a zero or weakly anomalous dispersion with an appropriately corrected retarding system. Without dispersion, neither the theoretical efficiency nor the optimum location and depth of the potential jump are significantly influenced by interaction of the electron beam with the second harmonic. With a 5 percent anomalous dispersion a potential jump can raise the efficiency of a traveling-wave tube to 42 percent and suppress the second-harmonic power to a -20 dB level. Figures 3; references 10: 8 Russian, 2 Western.
[110-2415]

2415
CSO: 1860

COLLECTOR EFFICIENCY OF AN O-TYPE TRAVELING-WAVE TUBE WITH AMPLIFICATION
AT TWO CLOSE FREQUENCIES

BELYAVSKIY, YE. D., BORISENKO, V. D. and PEREKUPKO, V. A.

[Abstract] An O-type traveling-wave tube with amplification at two close frequencies is considered. Its performance characteristics have been calculated as functions of the slip, according to the nonlinear theory of narrow-band signals, for the case of single-stage recuperation. The collector efficiency is found to be 30-35 percent lower than in the one-frequency mode. This difference decreases, however, as the two amplitudes become more unequal. The trends differ somewhat below and above saturation in the interaction space, but remain generally valid over a wide range of the space charge parameter 4QC from 0 up. Figures 1; references: 3 Russian.
[110-2415]

2415
CSO: 1860

USSR   UDC 621.372.543

AN OSCILLATORY SYSTEM ON COUPLED LINES FOR FREQUENCY STABILIZATION

CHEKANNIKOV, B. A. and CHISTOVA, V. S.

[Abstract] An oscillatory system which consists of a line with an active
element such as a Gunn-effect diode and a trimmer line coupled to it for
frequency tuning is also suitable for frequency stabilization, according to
the equation which relates the resonance frequencies to the circuit parame-
ters. On the basis of this equation, the condition can be established under
which the frequencies of the coupling will become almost independent of the
dynamic capacitance of the active element. Using this condition and with
the aid of graphs of capacitive parametric frequency modulation, it is pos-
sible to design oscillators with a higher stability where the mean dynamic
capacitance of the active element strongly depends on both voltage and fre-
quency. The feasibility of this has been confirmed by experiments. Figures
2: references 4: 3 Russian, 1 Western.
[110-2415]

2415
CSO: 1860

USSR   UDC 621.372.6:621.3.029.6

DETERMINING THE SCATTERING MATRIX OF A MICROWAVE NETWORK CIRCUIT

BABAK, L. I.

[Abstract] The author considers calculation of the scattering matrix of
a complex microwave circuit represented as a connection of two electric
circuits, one of which is a set of unconnected multiterminal networks,
while the other circuit is a communication system, including loads connected
to some of the inputs of the first circuit. The technique proposed for cal-
culating the scattering matrix is based on the concept of the "matrix of
connections" [J. Shekel, TRANS. IEEE, 1974, v. CAS-21, No 1], and enables
operation with matrices of minimum dimensions with simple computational
formulas. It is shown that individual elements of the matrix can be found

without calculating the entire matrix. An example is given of application of the proposed technique to determination of the scattering matrix of a parallel connection of two two-terminal pair networks. The solution involves inversion of a fourth-order matrix, which compares favorably with conventional methods requiring inversion of sixth-order and eighth-order matrices. Figures 2; references 8: 4 Russian, 4 Western.
[81-6610]

6610
CSO: 1860

OPTIMIZING THE CHARACTERISTICS OF FLANGE GATES IN THE MILLIMETER BAND

BOCHKAREV, A. I., KURUSHIN. YE. P. and YATSKAR', G. S.

[Abstract] Studies are done to determine the optimum position of a ferrite post in a T-circulator. It is shown that the central tuning frequency of the gate can be varied and the frequency response can be considerably modified by changing the position of the ferrite post. At the same time, the magnetization intensity can be reduced, which is important for devices in the shortwave region of the millimeter band. It is shown that with a reduction in magnetization, a shift in the position of the ferrite post away from the plane of symmetry has a greater effect: a shift toward the output port increases the working frequency band while simultaneously reducing the magnetizing field. Satisfactory agreement is observed between experimental and theoretical results. Figures 1; references 5: 4 Russian, 1 Western.
[81-6610]

6610
CSO: 1860

USSR   UDC   621.376.4

COMPARATIVE EXPERIMENTAL STUDY OF SOME PHASE-KEYING DEMODULATORS

CHAN VAN MIN, Socialist Republic of Vietnam

[Abstract] A comparative study made done on different types of phase key-
ing demodulators in a unified experiment and under identical conditions.
A block diagram is given of the setup used for measuring the interference
immunity of the demodulators. The following kinds of demodulators were
studied: 1) A coherent demodulator with RC filter at the phase detector
output with wideband interference; 2) A coherent demodulator with reset at
the output of the detector with wideband interference; 3) A coherent demodu-
lator with matched filter in the channel preceding the detector, and with
the filter at the output of the phase detector disengaged; 4) A linear co-
herent demodulator with wideband interference; and 5) A nonlinear coherent
demodulator with wideband interference. It was found that interference im-
munity is highest for a demodulator with integrator with reset. The circuit
with matched filter in the channel preceding the detector has interference
immunity that approaches that of the best case. When the signal-to-noise
ratio is less than 2, this circuit has better interference immunity than the
demodulator with integrator. Figures 2; references: 4 Russian.
[81-6610]

6610
CSO: 1860

37

USSR

USE OF ACTIVE ELEMENTS IN P-N-P-N STRUCTURE EQUIVALENTS FOR COMPENSATING THE TEMPERATURE DRIFT OF PARAMETERS OF THEIR S-TYPE CURRENT-VOLTAGE CHARACTERISTICS

STEPANOVA, L. N.

[Abstract] The base-emitter voltage of transistors decreases by 2-3 mV/°C and, consequently, they are switched on and off at a correspondingly lower supply voltage. Here a circuit is described for thermal compensation of transistors in a p-n-p-n-structure equivalent with an S-type current-voltage characteristic which uses positive feedback through another transistor. In the scheme the emitter voltage of this auxiliary transistor will increase with rising temperature so as to compensate the voltage decrement at the base-emitter junction of any p-n-p-n transistor and to cut the latter off. A typical circuit has been designed for such a compensation of voltage and current drifts in a p-n-p-n structure consisting of a KT301C-KT326B transistor pair. Calculations and tests indicate that sometimes the drift of switch-on parameters can be compensated with one transistor only. With two transistors there will be an almost full compensation of the switch-off parameters and a slight overcompensation of the switch-on parameters. Figures 3; references 6: 2 Russian, 4 Western.
[114-2415]

2415
CSO: 1860

EXPERIMENTAL STUDY OF AN AUTODYNE MIXER BASED ON A GUNN DIODE

MALYSHEV, V. A., RADCHENKO, A. F. and LEVTEROV, A. N.

[Abstract] The paper gives the results of an experimental study of an auto-
dyne mixer based on a Gunn diode in the upper part of the millimeter wave-
band with external input signal source. The Gunn diode was connected in a
waveguide cavity with a shorting piston on the end for tuning over a range
of 27-35 GHz. Constant voltage was applied to the diode from an external
rf source through a choke for blocking the intermediate frequency. While
the proposed autodyne mixer has a somewhat higher noise factor than mixers
based on Schottky-barrier diodes, the Gunn-diode autodyne mixer needs no ex-
ternal heterodyne, and it has a considerable advantage in conversion: the
conversion losses of mixers based on Schottky-barrier diodes are about 6 dB
in the 30-40 GHz range, whereas the Gunn-diode mixer has a signal gain of
10 dB. Figures 3; references 7: 3 Russian, 4 Western.
[81-6610]

6610
CSO: 1860

DYNAMIC INDICATION

VIRYUKOV, S., Moscow

[Abstract] Two variants of a dynamic indicator built with digital glow
tubes are available. Both include a 1-10 kHz pulse generator and a counter.
In the first variant the conversion factor is 10 and the counter is followed
by a decoder transmitting signals to three glow tubes in parallel, each load-
ed with a comparison circuit which also receives signals from the counter
directly. The decoder can become overloaded here, a drawback of this vari-
ant. In the second variant the conversion factor is equal to the number of
indicated symbols and the counter is followed first by four multivibrator-
commutators (K155KP7 or K155KP5 microcircuits) replaceable with ring shift

registers and OR-AND circuits, then by a decoder transmitting signals to
three glow tubes which also receive signals from the counter directly through
another decoder. Unlike in the first variant, here only one symbol is light-
ed at any time, which eases the load on the decoder connected across the com-
mutators or shift registers. Dynamic indication offers a saving in hardware,
dependent on the degree of circuit integration, when the number of symbols
is larger than 4-6. Typical is a 5-symbol indicator which uses either five
AL304A (A1304B) semiconductor devices with a common cathode and eight anodes
or an ALS311 module with five analogous indicators. The code converter also
needed here is built with one K514ID1 microcircuit replacing four series
K131 or K130 microcircuits. Figures 3.
[117-2415]

2415
CSO: 1860

AN AUTOMATIC SYSTEM FOR ORIENTING THE SENSORS OF AN ULTRASONIC FLAW
DETECTOR

BERDYANSKIY, M. G., candidate in technical sciences, KOSTYUKOV, B. V.,
UL'YANOV, V. M., LOBACHEV, A. A., KRYLOV, A. A., BOL'BOT, V. K., SOSNOVSKIY,
M. I. and SIMANENKO, V. I., engineers

[Abstract] The Central Laboratory of Mechanization and Automation of the
Ukrainian Ministry of Ferrous Metallurgy has developed a system for automati-
cally tracking the ultrasonic sensors of a flaw detector that follows a pipe
weld. The system operates on the echo-shadow principle in which the weld is
followed by signal reflection from the inside ridge of the seam, and the
tracking system is checked by signal transmission through the weld. On a
scope display, these signals will be shifted if the symmetry of the sensors
is disrupted. When this happens, a control signal automatically reverses
the sensor tracking motor to bring the sensors back in line with the weld.
Installation of this orienting system will enable automatic quality control
of welds in pipes of all classes with the State Emblem of Quality. Figures
3.
[79-6610]

6610
CSO: 1860

METHOD OF FABRICATING PRINTED CIRCUIT BOARDS

TRUNTSEVSKIY, V. R. and LYULINA, V. I., engineers

[Abstract] A description is given of a method of applying a photoresist
of the "cold enamel" FPP type to blanks in the automated fabrication of
printed circuit boards. The quality of the picture of the printed circuit
depends to a considerable degree on the thickness and uniformity of the
photoresist layer. With the methods presently used it is not possible to
apply liquid photoresists to blanks with predrilled and metalized holes,

since the photoresist flows into the holes and results in irregularity of the coating. The new method described uses rollers to apply a high-viscosity photoresist to a blank. Best results are achieved with a photoresist viscosity of 48 to 55 St on a VZ-4 viscosimeter. Blanks with predrilled holes and a prepared surface are electrolytically copper plated and then to the substrate, simultaneously on both sides, are rolled on five to six layers of an acid-resistant photoresist. Blanks are fed between rollers at a rate of 2 to 2.5 m/min at an angle of 40° to the horizontal plane. The rollers are made of polyester urethane. Most of the solvent included in the photoresist is removed from the film as it is applied because of its high volatility, and the rest of it is removed in drying. After three layers have been applied the coating is air dried for 5 to 10 min. For the purpose of thorough drying, infrared lamps are used at 60 to 65°C for 15 to 20 min. This treatment considerably improves adhesion of the photoresist to blanks and also improves acid resistance. Since with this method heating begins from the bottom layer outward, evaporation products are volatilized without delay, resulting in quick drying and the elimination of the formation of pores on the surface. A conveyer belt drying unit is employed with a speed of 0.3 to 1.25 m/min. The picture of the circuit is developed in a solution of sodium carbonate at 36 to 37°C. The boards are then treated in fluoboric copper plating electrolyte and a tin-lead fused electrolyte for 50 min in each electrolyte. This method makes it possible to predrill mounting holes and blanks on machines with numerical program control, eliminates flowing of the liquid photoresist into drilled holes, avoids the operation of coating the photoresist with lacquer, improves the quality of boards, and shortens their fabrication cycle because of the elimination of a number of operations, such as coloring, chemical and thermal hardening and lacquering. New equipment has been developed for implementing this method, including the U861M roller unit for applying liquid photoresists, the U898 exposing unit, and the A73 printed circuit board processing line for developing, removing the photoresist and etching.
[76-8831]

8831
CSO: 1860

USSR   UDC   621.313.323(088.8)

USING INTEGRATED TECHNOLOGY IN PRODUCING MICROMOTORS

TRIFONOV, N. I., engineer

[Abstract] A flowchart is given showing a continuous automated process for making stamped and welded multilayer windings with a diameter of more than 80 mm for end-type motors with an axial air gap and toroidal stator and rotor in powers of 10 W and up. The windings are stamped from copper or aluminum foil 0.2-0.5 mm thick. For miniature electric machines with windings less than 40 mm in diameter and powers of less than 5 W, precision stamping involves insurmountable difficulties, and is replaced by integrated techniques--photolithography and vacuum sputtering. A system is described for making micromotors from standardized modules with printed-circuit windings. The proposed system enables the designer to modify the characteristics of a motor by changing the number of modules without altering the diameter. Curves are given showing the relationship between the number of stator modules on the one hand, and the current density, induction in the air gap, and rotor field strength on the other hand. Improved heat transfer characteristics with printed circuit windings mean that the motors can work with current densities of 40-50 A/mm^2, and the use of metal oxide or semiconductor films for insulation could push this figure even higher. Figures 3.
[79-6610]

6610
CSO: 1860

43

USSR   UDC   53.082.64:621.316.8

METAL INDIRECTLY HEATED THERMISTOR

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 11, 1979 p 30

BADINTER, YE. YA., GELLER, V. M., candidates in technical sciences, and
STARUSH, I. G., engineer

[Abstract] A description is given of metal indirectly heated thermistors
of the TRP-1 type developed by the Kishinev Scientific Research Institute
of Electronic Instrument Making and manufactured by the Mikroprovod Scien-
tific Production Association in Kishinev. These thermistors consist of two
insulated indirectly heated thermistors in a common case.   The design of
these thermistors is based on USSR Patent No 179820, according to which the
sensitive element and the heater are fabricated from a potted microconductor
in glass insulation and are arranged parallel to one another. The sensitive
element is a nickel microwire 4 to 10 microns in diameter, and 12 to 18 mi-
crons with the insulation. Its nominal temperature coefficient of resistance
in the 20 to 100°C range equals $5.9 \cdot 10^{-3}$ °K^{-1}. The heater is fabricated from
a microwire made from an alloy with nominal resistivity of $1.5 \cdot 10^{-6}$ $\Omega \cdot m$ with
a temperature coefficient of resistance of $\pm 5 \cdot 10^{-5}$ °K^{-1}. Its diameter is
8 to 15 microns, and 15 to 25 microns with insulation. These thermistors
contain two insulated plates into each of which have been molded two pegs
and four conductors. The heater and sensitive element are wrapped in suc-
cession around the pegs and are soldered to the appropriate conductors. The
completed plates are then placed in an insulated case which is covered with
a cap and then an epoxy compound is used for sealing. The completed ther-
mistors weigh 100 g. Placing two indirectly heated thermistors in a common
case makes it possible to connect them differentially so that the heat sensi-
tive elements represent the adjacent arms of a bridge and the currents to be
compared pass through the heaters. When the heat sensitive elements are con-
nected to opposite arms of the bridge and a control signal is supplied to
heaters connected in parallel or series, it is possible to realize effective
non-contacting control of the transformation ratio of an unbalanced bridge.
[76-8831]

USSR   UDC   621.317

F4326 REAL TIME ONE-THIRD-OCTAVE SPECTRUM ANALYZER

BUL'BANYUK, A. F., NASTYUSHENOK, S. S., RYAZANOV, A. P. and TIKHANOV, G. A., engineers

[Abstract] A description is given of the F4326 real time one-third-octave spectrum analyzer developed at the All-Union Scientific Research Institute of Electronic Measuring Instruments in Leningrad and made in Zhitomir by the Elektroizmeritel' Plant imeni the 50th Anniversary of the USSR. This instrument is designed for the spectrum analysis of random and periodic signals in the audio-frequency band of 20 to 20,000 Hz and employs 31 one-third-octave band filters connected in parallel. This analyzer employs a linear operating mode making it possible to measure the integral level of an electrical signal in the 6 to 60,000 Hz frequency band. It measures the root-mean-square values of electric signals at the output of 32 selective circuits and displays information both by means of a pointer, a CRT and a digital readout, and also reads out measuring information in 8-4-2-1 binary coded decimal code. This spectrum analyzer is distinguished from similar instruments by its ability to display simultaneously on the CRT the entire structure of the spectrum both in linear and in logarithmic form. Its measurement range is 0.01 to 100 V and its measurement error in dB is $\pm$ 1.5 on the pointer and digital displays and $\pm$ 2 and $\pm$ 3, respectively, on the linear and logarithmic scales of the CRT. Its input impedance is 0.5 MΩ, its supply voltage is 220 $\pm$ 10 percent V (50 Hz $\pm$ 2 percent), its power requirement is 150 V·A, it measures 2(480 X 280 X 513) mm, and it weighs 25 to 30 kg. This analyzer can be used as a selective amplifier for it is supplied with an additional 1 VAC filter output. The instrument is housed in two separate cabinets, one holding the filter unit and the other the display unit. Controls are of the pushbutton type. As an analog-digital converter it employs a high-speed F203 digital voltmeter series-produced by the USSR instrument making industry. The input signal is fed from the input unit simultaneously to all one-third-octave filters and to standard frequency correction filters of the weighting type. A block diagram is given of the analyzer and the functions of its components are explained in detail. Figures 2.
[76-8831]

8831
CSO: 1860

NON-VACUUM PONDERMOTIVE INSTRUMENTS FOR MEASURING LASER POWER AND ENERGY

VALITOV, R. A., VALITOV, R. R., YEFIMOV, V. F., KOKODIY, N. G. and STARODUBTSEV, G. P.

[Abstract] Laser radiation pressure can be measured without evacuating the chamber containing the movement in a pondermotive instrument by using the fact that the radiometric effect at atmospheric air pressure is much weaker than the radiation pressure. Convective forces of air flow can be attenuated until they are negligible compared with radiation pressure by using a transparent plate as the sensor that responds to reflection at the interface, placing it in a strictly vertical position close to the inlet and outlet ports and at equal distances from them, and making the chamber from a material with high specific heat and thermal conductivity. Instruments for measuring laser power and energy are described that take advantage of these principles. Such devices take the form of a torsion microbalance that operates at atmospheric ambient air pressure. The laser emission produces a moment that acts on a sensor fastened to the end of the beam, converting it to angle of turn of the torsion pendulum, and this angle of turn is converted to an electric signal proportional to the size of the angle. An analysis is made of the solution of the Navier-Stokes equation that describes the convective air currents in the chamber. Instruments of this kind have been made that measure energy in ranges of 1-1000 J and 100-10,000 J, and power in ranges of 0.1-500 and 1-500 W on pulsed and cw laser emission with an error of 6-7 percent. Figures 2; tables 1; references 11: 10 Russian, 1 Western.
[81-6610]

6610
CSO: 1860

FREQUENCY COMPARATOR

BESPAL'KO, V. A., engineer

[Abstract] Frequency comparators are devices the state of whose output de-
pends on the sign of the difference in frequencies of the input signals.
They are employed in constructing automatic devices for the purpose of mak-
ing tolerance tests of the frequency of the pulse signal. Frequency com-
parators usually contain two counters to whose inputs are fed the signals
to be compared and whose outputs are controlled by the flip-flop of a mem-
ory. In the output of the counter having the higher input frequency a sig-
nal is formed for triggering the memory's flip-flop and then both counters
are reset by the output signal of the other counter and the cycle is re-
peated. With this method the operating precision of the comparator is in-
fluenced by the capacitance of the N frequency dividers, where $\Delta F = F_{op}/N$,
where F_{op} is the frequency with reference to which the comparison is made,
and the relative triggering error equals $\delta = \Delta F/F_{op} = 1/N$. These instru-
ment errors can be eliminated, false triggering from phase noise can be
eliminated and the reliability of the device can be increased by utilizing
an algorithm for the comparator's operation which enables hysteresis of the
comparator's response. The breadth of the hysteresis of its response equals
$\Delta F = 2\tau F_{op}^2$, whereby the relative triggering error is $\delta = 2\tau F_{op}$, where τ is
the difference in the periods of the input signals. This algorithm repre-
sents another method of detecting the sign of the difference in frequencies
between the input and reference signals. The basis of the method is the
fact that with the existence of a difference in frequencies, in addition
to the situation when pulses follow through both inputs of the comparator
alternately, with a beat frequency the situation also arises when the two
pulses pass successively through the input with the higher frequency. If
the frequencies of the signals in the inputs of the comparator are the
same, then the input flip-flops are switched by turns by the input signals
to the "0" state and then return to the original "1" state through a feed-
back loop. When two pulses arrive successively through one of the inputs,
by the second pulse the "1" is copied from the inverse output of the input
flip-flop to the output of the memory flip-flop and in this state inter-
locking takes place. The existence of a delay in the circuit makes it pos-
sible for triggering of the comparator to take place with a specific differ-
ence, τ, in the periods of the input signals. Releasing of the flip-flop
is possible only when two pulses are fed successively through the second
input and the feedback loop of the memory flip-flop is triggered. With $\delta =$
1 percent and $\tau = 2.5$ ns the maximum frequency with reference to which

comparison can be made equals 2 MHz. When series 133 and 530 elements are employed, $\tau = \sim2.5$ ns, and 3 ns when only series 133 elements are used. Figures 2; references 2: 1 Russian, 1 Western.
[76-8831]

USSR   UDC   621.373.001.5

AN OSCILLOGRAPH WITH PHOTOGRAPHIC EXPOSURE OF THE SPACE DISTRIBUTION OF THE ELECTRIC FIELD DUE TO A SIGNAL

BASOV, A. A., VOROB'YEV, A. A. and KATAYEV, I. G.

[Abstract] Oscillography of one-shot electric signals with cathode-ray tubes is already possible with a time resolution of the order of 10^{-10}s. It is still necessary to extend the bandwidth of the vertical deflection system and to form large voltage gradients for the horizontal sweep. This can be achieved by replacement of the retarding system with a homogeneous transmission line and the time sweep of a signal with photographic exposure of its electric field distribution in space. In an electronic variant of such an oscillograph a homogeneous stripline is placed between the horizontal deflection system and the screen. In an optoelectronic variant, furthermore, the electron beam is replaced with a laser beam. A signal deflector and a sweep deflector, both using crystals with the transverse Pockels effect, are installed here and the effect of electron-optical conversion on the resolving power is overcome by making the light spot much wider than the detachable dashline. The resolution of such an oscillograph is of the order of $4 \cdot 10^5$ Å and its sensitivity comparable to that of conventional cathode-ray oscillographs. It should be particularly useful for measuring high-power signals in the megawatt range. Figures 3; references 6: 5 Russian, 1 Western.
[110-2415]

USSR   UDC   681.128.6.018.2

MICROWAVE LEVEL GAUGE

MARFIN, V. P., KUZNETSOV, V. I. and ROZENFEL'D, F. Z., engineers

[Abstract] A description is given of a level gauge which operates on the
radar principle and utilizes frequency-modulated microwaves and was devel-
oped at the Ryazan' Teplopribor Plant Special Design and Technology Bureau
for Level Gauges (SKTBU). A microwave oscillator sounds the medium whose
level is to be determined by means of frequency-modulated oscillations pass-
ing through a circulator, an antenna and a radiotransparent mounting cover-
ing the container. The reflected signal passes through the circulator and
enters a mixer which also receives a signal from the microwave oscillator,
attenuated by the circulator. From the mixer's output a signal is received
with a beat frequency which is held constant by means of a follower consist-
ing of a selective amplifier, a frequency discriminator, an integrator and
a sawtooth generator. The level is monitored and measured as follows: The
harmonic signal from the selective amplifier is fed through a shaper from
which are pulses of short length are picked up, formed when the voltage of
the beat signal passes through zero, with a single signal formed in two
passes. These pulses enter one of the inputs of a coincidence circuit, and
to the second input pulses are fed formed by another shaper from the return
cycle of the sawtooth wave. From the output of the coincidence circuit the
pulses travel through an up-down counter which subtracts or adds them, de-
pending on the change in level, i.e., an increase or drop. The direction
of the change in level is determined by resolution of the beat frequency
signal into two orthogonal components which are then fed separately to the
subtracting and adding buses of the up-down counter. The result is reflect-
ed on a display. Readout accuracy is accomplished by the fact that pulses
with the beat frequency are fed to one of the inputs of a phase detector in
the form of a flip-flop to whose other input are fed the shaped pulses of
the sawtooth generator. At the phase detector's output a square-wave pulse
is obtained whose length varies with a change in level within the range of
one half the wavelength of the microwave oscillator. The length of this
pulse is measured and displayed digitally. As the microwave oscillator is
used a Gunn diode with varactor frequency tuning and operating in the 3 cm
band. This accounts for the small size and low power of this instrument
as compared with instruments employing electron tube devices. In measuring
levels from 0 to 12 m the absolute error equals $\pm$ 4 mm. This level gauge,
called the RUMB-IBK, has been accepted for series production at the Teplo-
pribor Plant. Figures 2; references: 4 Russian.
[76-8831]

8831
CSO: 1860

OPTRONS FOR RADIO APPARATUS

NOSOV, YU. P.

[Abstract] Optrons and optoelectronic integrated circuits feature an ideal
electrical isolation of output from input. The optical stage consists of
a radiator and a photoreceiver, both semiconductor devices, a very competi-
tive replacement for pulse transformers and useful for unidirectional data
transmission or for decoupling of radio system components where the poten-
tial difference is large. Optrons now produced in the USSR include the
high-speed AOD101 diode optron and the AOD120 optron pair, the latter with-
out a housing and both serving as general-purpose components for digital as
well as analog data transmission systems. They are compatible with series
K155 integrated circuits. Another optron of interest is the AOD111A with
an open optical reflection channel, used for quality control of reflecting
surfaces and for contactless rpm measurement. Optoelectronic switches in-
clude the K249LP1 in a metaloceramic housing and the K293LP1 in a thermo-
plastic housing, also the K249KN1 commutator of analog signals. Use of
these devices is improving the performance characteristics of radio appara-
tus. Figures 6; tables 3.
[114-2415]

2415
CSO: 1860

DESIGN OF THE TANK CIRCUIT FOR A GUNN-EFFECT MICROWAVE OSCILLATOR ACCORDING
TO THE DIFFRACTION APPROXIMATION OF THE PERTURBATION METHOD

RAYEVSKIY, S. B. and RUDOYASOVA, L. G.

[Abstract] Modern microwave oscillators contain electron devices such as a
Gunn-effect diode, which are structurally shifted away from the resonator
axis so as to ensure a higher frequency stability and facilitate tuning.
Design of the tank circuit on the basis of closed formulas is not possible
and by the variation method is mathematically unwieldy. Here the perturba-
tion method is proposed, in the diffraction approximation, for calculating
the shift of the resonance frequency due to insertion of a metallic diode
housing into the cavity. Accordingly, the field in an empty resonator cavi-
ty is resolved into plane waves and then the diffraction of each at the in-
clusion is determined. An algorithm of calculating the frequency shift as
a function of characteristic geometrical ratios has been constructed which
starts from the Hertz vector. Calculations have been checked against ex-
perimental data and the error found not to exceed 5 percent over the entire
tuning range of such an oscillator. Figures 3; tables 1; references 10:
7 Russian, 3 Western.
[110-2415]

2415
CSO: 1860

RESOLVING POWER OF ELECTRIC SENSORS THAT DETERMINE THE THICKNESS OF A
LIQUID FILM

GOLOVIN, V. A., candidate in technical sciences, and FEDOROV, A. S., engineer

[Abstract] An analysis is made of the resolving power of slot type sensors
within the limits of linear dependence of sensor conductivity on liquid film
thickness. The nonuniformity profile takes the form of a since wave, which
is a fairly general shape for film flows. The method of electric models is
used because of its simplicity compared with the method of conformal mappings.
It is found that the working range of a sensor with symmetric electrodes is
wider and sensitivity is lower than for a sensor with a central electrode.
When the velocity of wave motion of the film is constant, the slot type sen-
sors behave like an integrating circuit with a time constant that increases
with the ratio of average film thickness to a characteristic dimension of
the sensor. High-frequency correction should be used to improve resolution.
The paper was presented by the Department (Kafedra) of Steam and Gas Turbines,
Moscow Order of Lenin Power Engineering Institute. Figures 2; references:
5 Russian.
[80-6610]

6610
CSO: 1860

MULTIPURPOSE OPTIMIZATION OF THE CHOICE AMONG ALTERNATIVES FOR CONTROLLING
LONG-RANGE TRANSMISSION OF ALTERNATING CURRENT

BORISOV, R. I., candidate in technical sciences, docent, and GRUNIN, O. M.,
engineer

[Abstract] Several criteria of effectiveness must simultaneously be taken
into account when setting up automated control of long-distance transmission
lines in intersystem distribution and power grids. Operational control of
power transmission systems involves consideration of criterion functionals

in terms of minimum fuel expenditure, reliability, maximum productivity and other factors that form an effectiveness vector ϕ in the aggregate. The authors consider the problem of optimum control of the working conditions of an intersystem power grid with regulation of the reactive powers of the energy sources. The local effectiveness criteria of the problem are: ϕ_1-- the condition of minimum losses of active power; ϕ_2--the condition of maximum productivity determined from the voltages of nodal intersystem points for normal working conditions; ϕ_3--conditions of reliability of operation of the intersystem power grid. The multipurpose control problem is formulated as a problem of minimizing the generalized function of locally optimum solutions. The overall solution takes the form of relations for the power regulation of reactive sources at control points as a function of the transmitted active power. The paper was presented by the Department (Kafedra) of Electrical Stations and Electrical Systems, Tomsk Order of the October Revolution and Order of the Red Banner of Labor Polytechnical Institute imeni S. M. Kirov. Figures 1; references 6: 5 Russian, 1 East German. [80-6610]

6610
CSO: 1860

STATISTICAL ANALYSIS OF INTENTIONAL DISCONNECTS OF 35-500 kV OVERHEAD TRANSMISSION LINES

EDEL'MAN, V. I., Candidate in Technical Sciences, BARG, I. G., KOROBANOV, S. V. and PRIPUSKOVA, T. P., engineers, Ekonomtekhenergo and Soyuztekhenergo Trusts

[Abstract] Intentional disconnects of 35-500 kV power transmission lines are classified as maintenance or servicing disconnects, disconnects for servicing of connected equipment, disconnects for reconstruction of power lines, and disconnects on the request of other organizations for the performance of work in the vicinity of the power transmission lines. The number of intentional disconnects on lines of this size is an order of magnitude greater than the number of emergency disconnects. These disconnects therefore significantly influence the reliability of electric power networks. The most frequent causes of the various classifications of disconnects are

statistically analyzed. The mathematical expectation and mean square devi-
ation of the mean number of disconnects per year are calculated for certain
types of power lines. Figures 1; tables 8; references: 4 Russian.
[73-6508]

6508
CSO: 1860

MODERNIZATION OF THE ELECTRIC DRIVE OF THE TELESCOPIC GROUNDING UNIT FOR A 500 kV DISTRIBUTION SYSTEM

D'YAKOV, V. I., Candidate in Technical Sciences, KUVSHINOV, S. S., VASIL'EV,
B. G., engineers, and FROLOV, A. N., Candidate in Technical Sciences, Ivan-
ovo Power Engineering Institute imeni V. I. Lenin, Kostromy Regional Elec-
tric Powerplant, Ivanovo Institute of Chemical Technology

[Abstract] The Ivanovo Institute of Power Engineering imeni V. I. Lenin
has developed and manufactures a special electric drive for the high-voltage
telescopic grounding element of the 500 kV distribution system (ORU) for the
Kostromy Regional Electric Powerplant. Disadvantages of manual systems are
noted. The use of pneumatic drive requires special pneumatic lines, and
pneumatic systems are relatively unreliable. Therefore, a linear induction
motor was selected as the drive. The operating characteristics of the ground
system are presented. Figures 2: references: 3 Russian.
[73-6508]

6508
CSO: 1860

USSR UDC 621.319.4.001.24.004.15

INCREASING THE RELIABILITY OF POWERFUL BANKS OF STATIC CAPACITORS

LIKHACHEV, F. A., Candidate in Technical Sciences, Soyuztekhenergo Trust

[Abstract] Type "T" 220/35/10 kV substations carry two banks of static capacitors for regulation of voltage in the 220, 35 and 10 kV lines. The technical characteristics of the devices are presented. Between 1973 and 1977, 12 voltage transformers and 18 arc-damping chambers of the MKP-35 breakers were damaged, in spite of frequent overhauls of the breakers (after each 40-50 switchings) including changing of oil. Studies were performed to determine the reason for the continued damage to the equipment. It was found that repeated connection and disconnection of the bank capacitors can cause thermal damage to the windings of the transformer by the capacitor discharge current if the relative humidity of the ambient air is low. Damage to high-voltage breakers usually occurs during capacitor disconnects when two-phase shorts to ground develop. The remedy suggested is removal of the voltage transformers of the capacitor circuit. The capacitor insulation must also be kept clean, particularly during long periods of disconnection, and damaged capacitors must be replaced only by capacitors containing discharge resistors. The capacitors must be connected to buses with flexible connectors to prevent damage to seals during temperature changes. Figures 4.
[73-6508]

6508
CSO: 1860

DESCRIPTION OF RADIO PULSE CIRCUITS

SAVIS'KO, P. A. and NASTRADIN, V. P.

[Abstract] An analytical model of a lagging pulse circuit and its response
to random pulse signals is developed for the case of a pulse duration much
shorter than the circuit switching time. The circuit switches on and off
independently at instants of time also independent of the pulse parameters.
The probability of a single pulse appearing at the input is given, its dura-
tion and amplitude being random quantities characterized by respective proba-
bility densities. A monotonically rising circuit response to an external
signal of constant amplitude and a monotonically falling circuit response
to termination of this signal serve as the basis of this model. Both re-
sponse functions are assumed to be twice continuously differentiable. The
general mathematical relation describing the dynamic characteristic of such
a circuit is applied to the special cases of a constant pulse duration,
constant pulse duration and amplitude, and a linear pulse circuit or deter-
ministic pulse signals. The model is used for calculating the performance
of a peak detector. Figures 2; references: 5 Russian.
[110-2415]

2415
CSO: 1860

INTRICATE MODES OF PULSE GENERATION IN A RESONATOR WITH A NONLINEAR BOUNDARY

VESNITSKIY, A. I. and POTAPOV, A. I.

[Abstract] An experimental study was made of a parametric pulse generator
for the 0.3-3 GHz frequency band with a 0.4-0.9 m long coaxial waveguide
segment serving as a the resonator and closed by a nonlinear variable-capaci-
tance 1A401 diode. A stroboscopic 2-beam oscillograph with a 5 GHz bandwidth

was used for recording the subnanosecond pulses and tracking the pump level. Four ranges of pulse generation could be discerned, with a minimum pulse duration of 0.2 ns within the stability range at low pump levels of 3-4 V amplitude. Within the second range, characterized by instability, the pulse repetition rate decreased to one half. Within the third range three modes of generation were observed: one pulse for each pump period, every third pulse missing, pulse repetition rate decreased to one third with a transition from unipolar to bipolar pulses and a further decrease of their repetition rate. Within the next stability range at high pump levels the pulse repetition rate decreased to one half or one fourth. The amplitude-frequency characteristic was rising at low pump levels and falling at high pump levels, both instability ranges in between being characterized by zones of stiff excitation. Figures 2; references: 2 Russian.
[110-2415]

2415
CSO: 1860

USSR   UDC   681.17:621.378

VISUAL MONITORING OF TECHNOLOGICAL OPERATIONS IN MICROELECTRONICS BY MEANS
OF A LASER EPIDIAPROJECTOR

GRISHIN, S. V., KLOPOV, M. M. and SELYUTIN, O. N., engineers

[Abstract] A description is given of an experimental model of a laser epi-
diaprojector developed at the Penza branch of VNITIpribor [All-Union Scien-
tific Research Technological Institute of Instrument Making] and designed
for visual monitoring of photographic templates in microelectronics produc-
tion. The optical system of the instrument was created at the Moscow Insti-
tute of Electronic Equipment. The use of monochromatic light of lasers of
type LG-106M1 with a wavelength of 0.488 microns and LG-36A with a wave-
length of 0.632 microns in the epidiaprojector makes possible a magnifica-
tion of 200 to 1000 with replaceable lenses and good color contrast. The
magnified image has sufficient brightness for observing it in an undarkened
room. Three modes are possible: epiprojection, i.e., the use of reflected
light, diaprojection, i.e., the use of transmitted light, and epidiaprojec-
tion, i.e., a combination of the two. In epiprojection green light is used
to determine flaws on the surface of the opaque coating of photographic
templates, and by means of diaprojection using a red light it is possible
to detect irregularities at the edge of topological drawings and splits in
a transparent substrate. The combined mode enables total inspection. The
high magnification, high resolution of one micron at maximum magnification,
and distinct color contrast on the epidiaprojector's screen make it possible
to detect well punctures and scratches in the coating of templates as red
spots on a field of green. The use of the coherent light of lasers has
made possible improvement in contrast in the image of a dark spot against
a bright background of double that achieved by other methods, and of more
than double for a thin dark line. In addition, resolution has been improved
twofold. The lack of infrared light makes it possible to reduce substan-
tially the heating of objects being monitored. The epidiaprojector described
here can also be used for checking precision instrument products. The high
magnification afforded makes the unit well suited for quality control of
highly integrated microelectronics products. Figures 2.
[76-8831]

8831
CSO: 1860

USSR   UDC 621.372.8

SYNTHESIS OF A WIDEBAND DEVICE ACCORDING TO R.M. PAGE

KOGAN, B. L.

[Abstract] The principle of connecting four sum-difference bridges in the
form of hybrid rings, according to R. M. Page [IRE Convention Record, 1955,
p . 8, pp 132-134] and applicable to monopulse radar, is extended to a de-
vice for operation over a frequency range of several octaves. This is made
ossible by using hybrid rings with phase inversion and by connecting identi-
cal matching circuits across the inputs and the outputs. Theoretically this
is demonstrated on the basis of the balance properties and the wave matrix
of such a system. As practical matching circuits are considered fourpole
networks consisting of ladder transformers in cascade, short-circuit loops
in parallel and open-circuit loops in series. Here three optimum configura-
tions are shown and the wave immitances of circuit components, the basic de-
sign and performance parameters, have been calculated. The matching circuits
can have, for example, a Chebyshev standing-wave-ratio function. Use of
coupled lines instead of phase inversion is feasible but difficult. Figures
4; tables 1; references 5: 2 Russian, 3 Western.
[110-2415]

2415
CSO: 1860

AMPLIFICATION OF OPTICAL PHONONS BY THE FIELD OF AN ELECTROMAGNETIC WAVE IN THE PRESENCE OF A MAGNETIC FIELD

SHMELEV, G. M., CHAYKOVSKIY, I. A., EPSHTEYN, E. M. and NGUYEN KUANG BAU, Institute of Applied Physics, Academy of Sciences MoldSSR, Kishinev

[Abstract] In a search for different methods of amplifying optical phonons, the authors investigate the influence that the combined action of an electromagnetic wave and a magnetic field have on attenuation of optical phonons. The damping constant γ is calculated in the presence of an electromagnetic field $\vec{E} = \vec{E}_0 \sin \Omega t$, and a magnetic field $\vec{H}$ in two cases: $\vec{H} \perp \vec{E}_0$ and $\vec{H} \parallel \vec{E}_0$. The analysis is done for a nondegenerate and a completely degenerate electron gas. Conditions of amplification of optical phonons are found in the regions of wave numbers that are "transparent" in the absence of an electromagnetic wave. It is shown that actuation of a quantizing magnetic field ($\hbar\omega_c \gg k_0 T$, where ω_c is the cyclotron frequency, T is the specimen temperature) widens the range of wave numbers where photostimulated attenuation is observed, and the amplification factor depends on the mutual orientation of the magnetic and electric field vectors. The maximum γ may reach 10^9-10^{10} s^{-1}. References 9: 8 Russian, 1 Western.
[74-6610]

6610
CSO: 1860

USSR   UDC 621.315.592

DIMENSIONAL REPOPULATION OF VALLEYS IN STRONG ELECTRIC FIELDS. II

KLIMOVSKAYA, A. I., KIRILLOVA, S. I. and SNITKO, O. V., Institute of Semi-
conductors, Academy of Sciences UkrSSR, Kiev

[Abstract] In many-valley semiconductors with weak electron-electron inter-
action, volume repopulation between valleys takes place for certain direc-
tions of a heating field. Accounting for this repopulation gives a qualita-
tive explanation of all kinetic and other phenomena in heating fields such
as conductance, permeance, birefrigence and the like. The considerable part
played by intervalley repopulation is due to the fact that the population of
valleys in a certain energy range is an exponential function of electron en-
ergy, whereas mobility is a power-law function of electron energy. There-
fore it should be possible to explain dimensional magnetoconductance on the
basis of dimensional repopulation of valleys. The authors give experimental
data on the influence that an electric heating field has on dimensional mag-
netoconductance in n-type silicon at 77 K. The results are compared with
theory, and the volumetric time and surface rate of intervalley relaxation
are determined for the first time for a silicon surface with standard treat-
ment. It is shown that dimensional magnetoresistance is determined by the
volume repopulation of valleys and by the length of intervalley relaxation,
which are in turn dependent on the heating field. The time of intervalley
relaxation was found to be $3 \cdot 10^{-9}$ s, and the rate of surface relaxation was
$\sim 6 \cdot 10^3$ cm/s. Figures 13; references 20: 16 Russian, 4 Western.
[74-6610]

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WEAK WAVE ABSORPTION BY A DONOR-ACCEPTOR SYSTEM IN A RESONANT LASER FIELD

KAZARYAN, I. M., MELIKYAN, A. O. and MINASYAN, G. R., Yerevan Polytechnical Institute imeni K. Marx

[Abstract] The quasi-energy spectrum of charge carriers in a semiconductor is considerably changed in the field of a strong electromagnetic wave with the frequency Ω exceeding the width of the forbidden band. A typical feature in this case is a gap that depends on the angle between the direction of the electron momentum and the electric field vector of the wave. On the other hand when the frequency of the strong electromagnetic wave is less than the width of the band of a semiconductor with donor and acceptor centers, resonant transitions may take place between bound electron states. Analysis of the high-frequency shift of ground donor and acceptor states for a model of shallow hydrogen-like impurity centers shows that the activation energy of these impurity centers can be varied by changing the intensity of the incident radiation and the concentration of the predominant dopant. In this paper the authors calculate the inter-impurity absorption factor of a supplementary weak wave with $\omega \sim \Omega$. The analysis is limited to the case where the Bohr radii of the acceptor impurity are much smaller than those of the donor impurity. Expressions are given for limiting cases of particular interest, and it is shown that the presence of impurity levels leads to anisotropy of absorption. The authors thank S. L. Arutyunyan for discussing the results of the research. References 7: 5 Russian, 2 Western. [74-6610]

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STEPWISE ACOUSTOCONDUCTANCE OF SEMICONDUCTORS

BUGAYEV, A. S., V'YURKOV, V. V., RYZHIY, V. I. and SHIBANOVA, N. N., Moscow
Polytechnical Institute

[Abstract] The change in static conductance of semiconductors under the
action of acoustic waves (acoustoconductance) can be attributed both to the
influence of these waves on the mobility of free electrons and holes, and
to their effect on free carrier concentration. However, acoustic waves may
alter both band conduction and the conductivity due to electron jumps with
respect to localized states. The authors investigate this jump mechanism
of acoustoconductance. The analysis applies to a lightly doped compensated
n-type semiconductor, assuming that the temperature is low enough so that
conductivity is stepwise. It is shown that acoustoconductance under the
given conditions is strongly dependent on temperature and donor concentra-
tion. The magnitude of the effect may differ for different directions of
sound propagation due to anisotropy of conductivity and sound, and also due
to the anisotropy of the wave functions of electrons on donors, which may be
due in turn to the anisotropy of the band structure of the semiconductor or
to the external magnetic field. The effect of stepwise acoustoconductance
may also arise in heavily doped compensated semiconductors and in amorphous
semiconductors. The authors thank Yu. V. Gulyayev, G. D. Mansfel'd, V. Ye.
Lyubchenko and V. V. Proklov for discussing the work and for constructive
criticism. Figures 10; references 10: 9 Russian, 1 Western.
[74-6610]

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INFRARED ABSORPTION AND OPTICAL TIME OF RELAXATION OF FREE CHARGE CARRIERS
IN SEMICONDUCTORS

VAKULENKO, O. V., Kiev State University imeni T. G. Shevchenko

[Abstract] The classical Drude-Zener electron theory of optical properties
of solids is valid for cases where the relaxation time τ of free carriers is
independent of their energy. According to this theory when $\omega\tau \gg 1$ the coeffi-
cient of absorption $K \sim \omega^{-2}$, where ω is the frequency of light. As $\omega\tau$ decreas-
es, the value of K approaches saturation. The energy dependence of τ cannot
always be disregarded in a nondegenerate gas in semiconductors. In this case
the spectral behavior of the coefficient of absorption of free charge carriers
takes the form $K \sim \omega^{-p}$ where p is not equal to 2 in the general case, but is
determined by the specific mechanism of energy scattering. On the basis of
an empirical relation for the relaxation time as a function of the energy of
a photon of absorption the author attempts to unify the classical theory with
quantum theories, and to generalize the classical formula for K so that the
results are valid in the far quantum region as well. It is shown that the
introduction of optical relaxation time unifies the quantum and classical
theories for infrared absorption by free charge carriers. Formulas are giv-
en for calculating the coefficient of absorption over a wide frequency range
from the measured electrical properties of solids. References 6: 1 Russian,
5 Western.
[74-6610]

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TWO-FREQUENCY OSCILLATION IN GUNN DIODES

ALTUKHOV, I. V., VASIL'YEV. N. A., KAGAN, M. S., KALASHNIKOV, S. G., KUKUSHKIN, V. V. and LUKASH, V. S., Institute of Radio Engineering and Electronics, Academy of Sciences USSR, Moscow

[Abstract] An investigation is made of the influence that various transit conditions of oscillation in Gunn diodes have on rf power. Microwave oscillations are excited in specimens of GaAs with moving electric domains simultaneously on two frequencies: low-frequency oscillations with frequency close to the transit frequency, and high-frequency oscillations with frequency considerably higher than the transit frequency that arise in an rf cavity due to the negative resistance of the specimen with domain. It is found that the rf power increases with a reduction in the amplitude of the low-frequency voltage, and shows a typical stepwise change. Different transit-resonance modes of operation of Gunn diodes are analyzed to explain these results. It is shown that the observed relations can be qualitatively attributed to a change in the time of existence of a domain in the specimen as averaged over the period of the low-frequency oscillations. Figures 7; references 7: 4 Russian, 3 Western.
[74-6610]

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